Equations and Graphs Difficulty: Hard

Question Paper 2

Level	AS & A Level
Subject	Maths - Pure
Exam Board	Edexcel
Topic	Equations and Graphs
Sub-Topic	
Difficulty	Hard
Booklet	Question Paper 2

Time allowed: **40 minutes**

Score: **/33**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>76%	61%	52%	42%	33%	23%	<23%

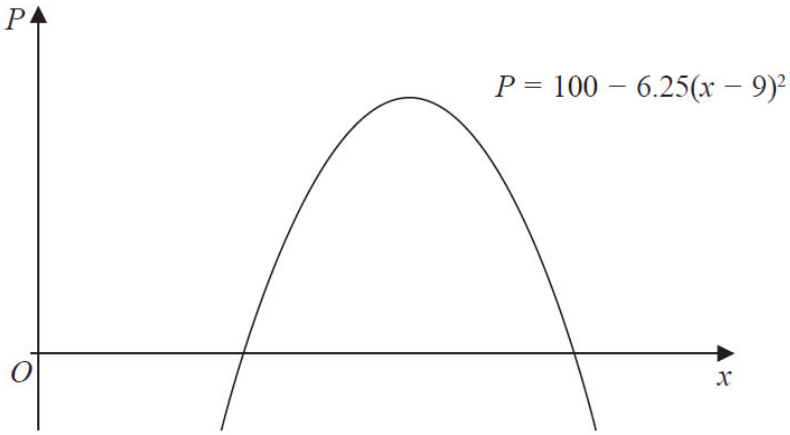

Figure 1

A company makes a particular type of children's toy.

The annual profit made by the company is modelled by the equation

$$P = 100 - 6.25(x - 9)^2$$

where P is the profit measured in thousands of pounds and x is the selling price of the toy in pounds.

A sketch of P against x is shown in Figure 1.

Using the model,

(a) explain why £15 is not a sensible selling price for the toy. **(2)**

Given that the company made an annual profit of more than £80 000

(b) find, according to the model, the least possible selling price for the toy. **(3)**

The company wishes to maximise its annual profit.

State, according to the model,

(c) (i) the maximum possible annual profit,

(ii) the selling price of the toy that maximises the annual profit. **(2)**

(Total 7 marks)

Question 2

The straight line with equation $y = 3x - 7$ does not cross or touch the curve with equation $y = 2px^2 - 6px + 4p$, where p is a constant.

(a) Show that $4p^2 - 20p + 9 < 0$ **(4)**

(b) Hence find the set of possible values of p. **(4)**

(Total 8 marks)

(a) Factorise completely $9x - 4x^3$ **(3)**

(b) Sketch the curve C with equation

$$y = 9x - 4x^3$$

Show on your sketch the coordinates at which the curve meets the x-axis. **(3)**

The points A and B lie on C and have x coordinates of -2 and 1 respectively.

(c) Show that the length of AB is $k\sqrt{10}$ where k is a constant to be found. **(4)**

(Total 10 marks)

$$f(x) = x^3 + 3x^2 - 4x - 12.$$

(*a*) Using the factor theorem, explain why f(x) is divisible by (x + 3). **(2)**

(*b*) Hence fully factorise f(x). **(3)**

(*c*) Show that $\dfrac{x^3 + 3x^2 - 4x - 12}{x^3 + 5x^2 + 6x}$ can be written in the form $A + \dfrac{B}{x}$, where A and B are integers to be found. **(3)**

(Total 8 marks)